

FILE COPY

FOREST INSECT LABORATORY
UNIVERSITY OF CALIFORNIA
BERKELEY, CALIFORNIA.

425 • db19

UNITED STATES DEPARTMENT OF AGRICULTURE

FOREST SERVICE

Forest Insect Laboratory,
841 Giannini Hall, Univ. of California,
Berkeley, Calif.

DEVIL'S GARDEN EXTERMINATION PROJECT

FINAL REPORT

MODOC NATIONAL FOREST

By

K. A. Salman



Berkeley-California

August 14, 1934

Copies
FILE
FCC
FPK
JCE
KAS
X

DEVIL'S GARDEN EXTERMINATION PROJECT

FINAL REPORT

MODOC NATIONAL FOREST

By

E. A. Salzman

Berkeley-California

August 14, 1934

DEVIL'S GARDEN EXTIRPATION PROJECT

FINAL REPORT

Results of forest insect control projects have been found to be of a temporary nature, all beneficial effects being lost in the general infestation trends after the second year following the operations. This raises the question as to whether the reinfestations arose from broods missed in the control work, or are the results of flight from uncontrolled areas. The Devil's Garden Extirpation Project was planned to answer that question and work was started on a program of intensive control in the fall of 1929. Intensive control followed in 1930 and 1931 but a commercial type of control against the overwintering broods only supplanted it during 1931 and 1932.

THE AREA

An isolated body of timber on Timbered Mountain in the Devil's Garden area of the Modoc National Forest was selected for the work. This area carries about 540 acres of commercial stand, site 4 quality. Surrounding this is a belt of scattered timber interspersed with juniper and mountain mahogany which covers an additional 5660 acres. This timber is sparse, scattered and of poor quality. The entire area can be considered a typical ridge type growing under critical environmental conditions. Sage brush flats or juniper clad ridges surround the entire area. Isolation was stated by Keen (1929) to consist of a non timbered belt of at least four miles, although Person (1930) found the nearest ponderosa pine to be within two miles in two places.

EXTENT OF PROGRAM

Insect caused losses have been cruised and marked in September 1929, April, June, August and October 1929, May and August 1930, May 1931, April 1932, July 1933 and May 1934. Control has been done in conjunction with all cruises of 1929, 1930, 1931 and 1932, utilizing solar heat methods during the summer work and the felling, peeling and burning method in the early spring work. Project plans and progress reports have been presented by Keen (1929, 1930), Salman (1931) and Johnson (1931, 1933, 1934). These should be consulted for detailed information.

INFESTATION CHARACTERISTICS

Keen (1929) stated that the infestation has reached a peak in 1926 and was subsiding during 1927. This would indicate the trends at the start of the work were one year in advance of those in the Happy Camp- Lava Beds area of the Modoc National Forest. Since the start of the work the infestation has been typical of the east side losses. The western pine beetle (*D. brevicornis*) and flathead borers (*Melanophila* spp.) have caused the greater portion of the losses with supplementary loss of a secondary nature caused by the mountain pine beetle (*D. monticolae*) and engraver beetles (*Ips oregoni* and *I. cmarginatus*). A small amount of loss has been encountered in which little or no insect infestation occurred. In such cases it cannot be considered that the loss was insect-caused.

Although many trees contained pure broods of a single species, mixed brooded trees have been more common. Many trees have suffered a partial kill, either in tops or limbs. It may be said that at least half of the overmature trees on the area have been attacked and partially killed, yet complete infestation or kill has not always followed. Such trees have constituted the uncontrolled portion of the infestation in the area for it would be impossible to reach the insects without felling and treating the majority of the overmature trees in the area. In all control work, those trees that have shown no apparent possibility of survival, or on which an active infestation has been indicated by the presence of brood or the fading of tops or branches to a considerable extent, have been treated. Trees with but a partial fade of the top alone, or of a few branches, have not been treated. In this way a great number of infesting insects have been missed. It has been shown by tree analysis records that at least some western pine beetle brood may have been missed in this manner, as partial infestations are known to occur below older flathead and engraver beetle attacks.

RESULTS OF THE EXPERIMENT

The primary objectives of the experiment were to determine (1) if extermination of western pine beetle were possible and (2) if reinfestation took place from missed brood or from spread from untreated areas. In addition, it has been possible to study the effects of four years of continued control on (3) the amount of loss and (4) the character of the loss.

1. Is Extermination Possible:-

The record of percent of total bark surface infested by the western pine beetle, as shown in table 2 and figure 2, indicates that four years of control, conducted without attention to the numerous trees slightly injured by top and branch infestations and under the conditions of environment and isolation affecting the stands in this area, was not sufficient to secure extermination of the species. In fact, considering the percent of total bark surface infested by the western pine beetle in 1928 as 100%, we find that the record shows the variations in the amount of bark infested by that species are in general agreement with the records of the total amount of timber infested as far as trends are concerned. In other words, the western pine beetle activity has, in general, varied directly with the amount of infestation. This experiment does not prove extermination impossible. Extermination does appear impossible unless all infested bark, including tops and large limbs of otherwise uninfested trees, are treated and unless the supply of beetles in the area is ^{not} augmented by others from outside sources. Such a treatment would be the equal of a heavy logging operation and greater isolation would be necessary to exclude outside populations.

2. Reinfestation Problems:-

Neither premise, i.e., that the reinfestation built up from missed brood or that the insects came into the area from outside sources, can be proven from the data secured during this experiment.

In the case of flathead borer infestation it is certain that the many top-killed trees, or even the fading branches of otherwise uninjured trees, could furnish a sufficient population to reinfest the area year after year. Treatment of from 84.4 to 100% of the overwintering broods for three years certainly would not furnish a sufficient population without the aid of such material. Tree No. 33-TK-51, in which ips ore oni alone was found in the top 17 feet of the bole, the remainder being green, is one example of the source of material, for every limb had been infested by flatheads, a large number of which had emerged by May, 1934. The numerous tree analysis records with upper bole infestations shown as "flathead emerged" or "old flathead kill", appear to be sufficient evidence of the source of much additional material for reinfestation.

In the case of the western pine beetle, it is not at all certain that reinfestation in the amounts indicated by the treating records, could have occurred from within the area. However, the fact that western pine beetle infestation below old top-kill injuries, yet not extending to the ground, nor of sufficient importance to kill the tree, have occurred, may explain at least a part of the reinfestation. It also seems possible to conclude that the isolation of the area is not sufficient. This conclusion cannot, however, be based on facts, for there has been developed no method that would allow the determination of the source of the material for reinfestation. As the isolation factor is not strong enough to preclude reinfestation from outside sources, the problem remains unsolved as far as this experiment is concerned.

3. Loss Record:-

Control, on the basis of the results presented in table 1 and figure 1, does not appear to have held the amount of loss down to a low level. Per acre loss is low, largely due to the low per acre volume of stand. Also the average percent of loss per year, which on the basis of a 10,000 M.B.M. stand is but about 0.6%, is low. However, it is believed the stand is much lighter than is shown by the old timber estimate given above and the percent of loss is correspondingly higher.

If control were effective in this area, it would disrupt the normal trend of infestation and flatten out the peaks of losses. Figure 3, which is a comparison of the infestation trends in the project area and those on the average of five untreated plots in the Happy Camp-Lava Beds area of the Modoc National Forest, shows that such a levelling has not occurred. In fact, when it is considered that infestations in two areas can seldom be compared on an exact basis, it must be concluded that the differences shown in the infestation records from the two areas are nearly alike and show no marked differences. The slightly smaller range of variation shown on the Devil's Garden area can be considered typical of infestations in the extreme fringe type timber in that part of the state.

4. Character of the Loss:-

The effects of control on the character of the infestation appear to have been marked. In the first two years of control there is an apparent drop in the amount of bark infested by the western pine beetle, although there is an increase in the amount of bark infested by flathead borers. In previous

spore it has been concluded that the control efforts have resulted in a drop in the western pine beetle infestation. In view of such information as is available on composition of other infestations during the period of experimentation, it appears doubtful that conclusion can be considered sound.

It is known that the western pine beetle was responsible for the greater portion of the losses of 1927 in both the Devil's Garden area and the Happy Camp-Lava Beds area of the Modoc National Forest. No tree analysis records are available to substantiate that conclusion, and it must rest on basal examination records. The trends of western pine beetle and flathead infestation in the Devil's Garden area, are shown in figure 2 for the period of 1928-1933. The records from the Happy-Camp-Lava Beds that are available are as follows:

In 1930 Person (1930) came to the conclusion that the western pine beetle had decreased markedly in importance during 1928 and 1929 and had reached a low point in 1930. He also observed that flatheads and engraver beetles were the most abundant species. These observations, founded on basal examinations, have not the value of the tree analysis records of later years but indicate a change similar to that occurring on the Devil's Garden Area.

Control projects during 1931, 1932 and 1933 gave additional information of a more exact nature in the form of analyses of the entire infested lengths of trees. These records are of the same type as those secured in Devil's Garden during the same period. The results are as follows:

YEAR	<u>% Bark Infested by</u> <u><i>D. Brevicornis</i> ; <i>Melanophila</i> Sp.</u>		<u>Date of previous control</u> <u>on the Area Sampled</u>
1931	51.7	52.0	1928
1932	79.1	8.2	1929
1933	46.7	35.2	1931

Comparison of these records with those from Devil's Garden reveal them to be startlingly similar. This comparison points to the fact that the infestation compositions as given in table 2 and figure 2 may represent but the natural fluctuations of the general region and are not the result of the control work done in the Devil's Garden area.

SUMMARY AND CONCLUSIONS

The Devil's Garden Extermination Experiment, which resulted in a record of infestations for the period of 1927 to 1933 (inclusive), a record of the composition of infestation for the four years of control (1929, 1930, 1931 and 1932) and for the two years following control, has resulted in the following conclusions concerning the work and its effects on the infestations in the area:

1. Extermination of the western pine beetle was not secured.
2. Flathead reinfestation may have come from within the area.
3. Western pine beetle reinfestation, at least to a large extent, probably came from without the area.
4. Control during 1929, 1930, 1931 and 1932 apparently did not reduce the losses markedly.

4. As far as can be determined infestation trends were not disrupted.
5. Changes in infestation composition, previously attributed to the effects of the control, apparently represent the normal fluctuations of the general region in which the project area is situated.

MANUSCRIPTS CITED IN THIS REPORT

- Johnson, P.C., 1931, Devil's Garden Extermination Project, Modoc National Forest, Calif., - Progress Report.
- 1933, Devil's Garden Extermination Project, Progress Report
- 1934, Devil's Garden Extermination Project, Modoc N.F., Calif.
- Keen, F. P., 1928, Western Pine Beetle Extermination Experiment, Timbered Mt. Unit, Modoc N.F.
- 1929, Work Plan for Devil's Garden Extermination Experiment, Season of 1929, Modoc N.F.
- Person, H.L. 1930, Personnel Report for June 2, 1930
- 1930, Report on Insect Conditions, Happy Camp- Lava Bed Area, Modoc N.F., Calif., Ninth Annual Report.
- Salman, K.A., 1931, Devil's Garden Extermination Project, Modoc N.F., Progress Report.

TABLE I

VOLUME OF TIMBER INVESTED AND TREATED

YEAR :	Seasonal Loss	:	Timber Treated:	:	% Loss Treated	:		:
:	Trees :	Volume BM	:	Trees :	Vol.B.M.	:	Summer	: Winter : Total
1927:	65	:	77,810	:		:	0.0	: 0.0 : 0.0
1928:	60	:	64,120	:	33	:	34,920	: 0.0 : 72.0 : 54.5
1929:	38	:	46,480	:	28	:	35,120	: 54.0 : 100.0 : 75.6
1930:	57	:	49,990	:	45	:	39,460	: 50.2 : 84.4 : 78.9
1931:	75	:	83,000	:	56	:	58,030	: 8.3 : 99.8 : 89.9
1932:	89	:	67,350	:		:	0.0	: 0.0 : 0.0
1933:	65	:	69,160	:		:	0.0	: 0.0 : 0.0

TABLE II

COMPARISON OF BANK AREAS INFESTED BY PRIMARY AND SECONDARY INSECTS.

YEAR	NO :Records	sq. ft.	sq. ft.	% tot.	sq. ft.	% tot.	sq. ft.	% tot.	sq. ft.	% tot.	sq. ft.	% tot.	sq. ft.	% tot.
1927	0	:	:	:	:	:	:	:	:	:	:	:	:	:
1928	53	: 8,293	: 5329	: 64.3	: 1916	: 23.1	: 173	: 2.1	: 433	: 5.3	: 379	: 4.6	: 13	: 0.1
1929	22	: 7,826	: 3951	: 50.5	: 2304	: 29.5	: 345	: 4.4	: 442	: 5.6	: 706	: 9.0	: 78	: 1.0
1930	46	: 12,723	: 3918	: 30.8	: 6874	: 54.0	: 324	: 2.5	: 504	: 4.0	: 990	: 7.8	: 113	: 0.9
1931	36	: 17,529	: 7017	: 40.0	: 9869	: 56.3	: 177	: 1.0	: 274	: 1.6	: 179	: 1.0	: 13	: 0.1
1932	45	: 29,752	: 13806	: 46.5	: 5621	: 19.1	: 950	: 3.2	: 180	: 0.6	: 137	: 0.5	: 85	: 0.3
1933	39	: 16,557	: 7811	: 47.3	: 7686	: 46.3	: 671	: 4.1	: 41	: 0.2	: 119	: 0.7	: 150	: 0.9
TOTAL	221	: 83,680	: 41935	: 50.1	: 34249	: 40.9	: 2640	: 3.2	: 1894	: 2.3	: 2510	: 3.0	: 452	: 0.5

PERCENT

FIGURE 2

PERCENT TOTAL BARK SURFACE INFESTED BY THE
WESTERN PINE BEETLE & FLATHEAD
BORERS

DEVIL'S GARDEN PROJECT

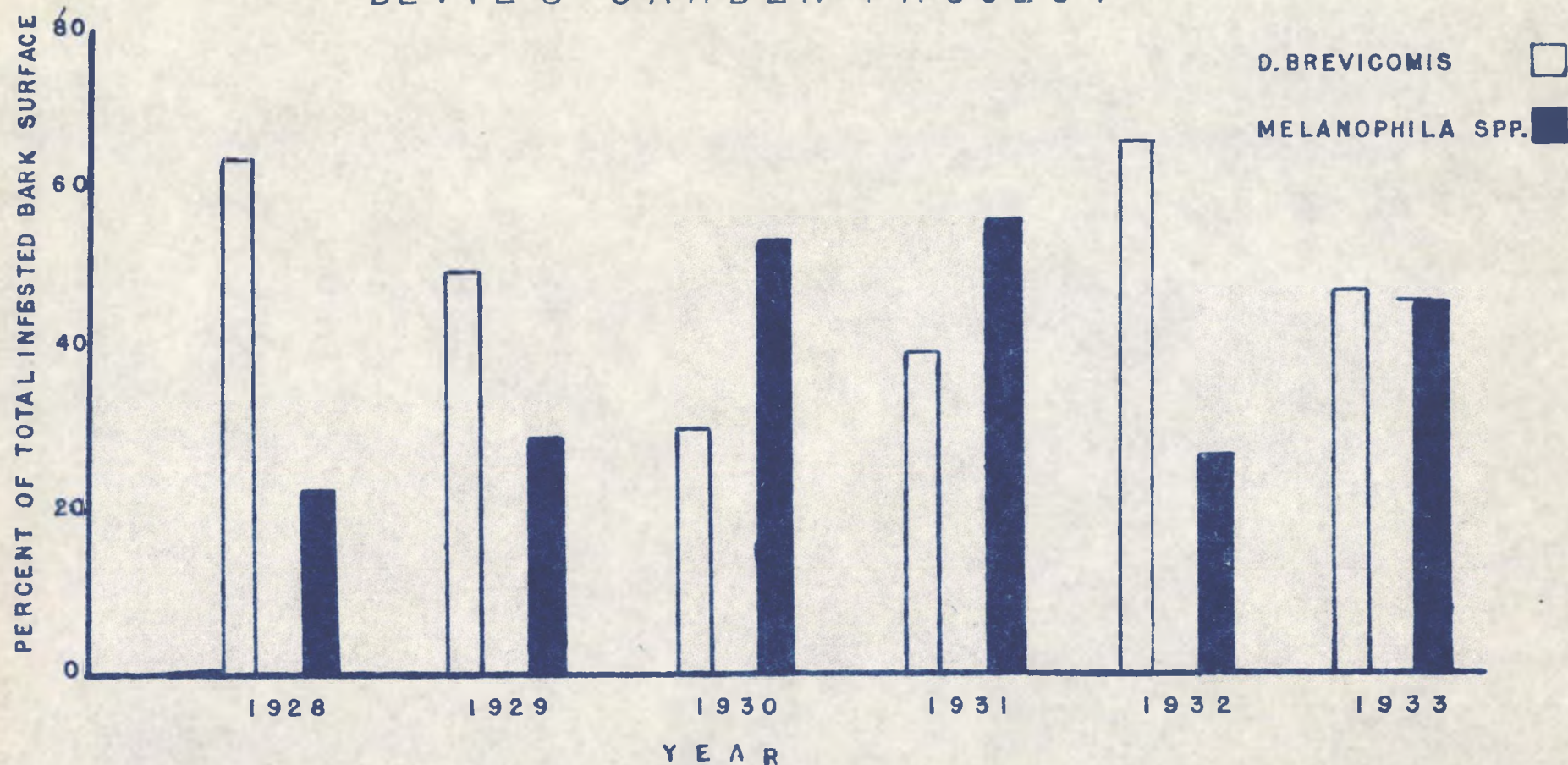


FIGURE 3

COMPARISON OF INFESTATION TRENDS

DEVIL'S GARDEN PROJECT

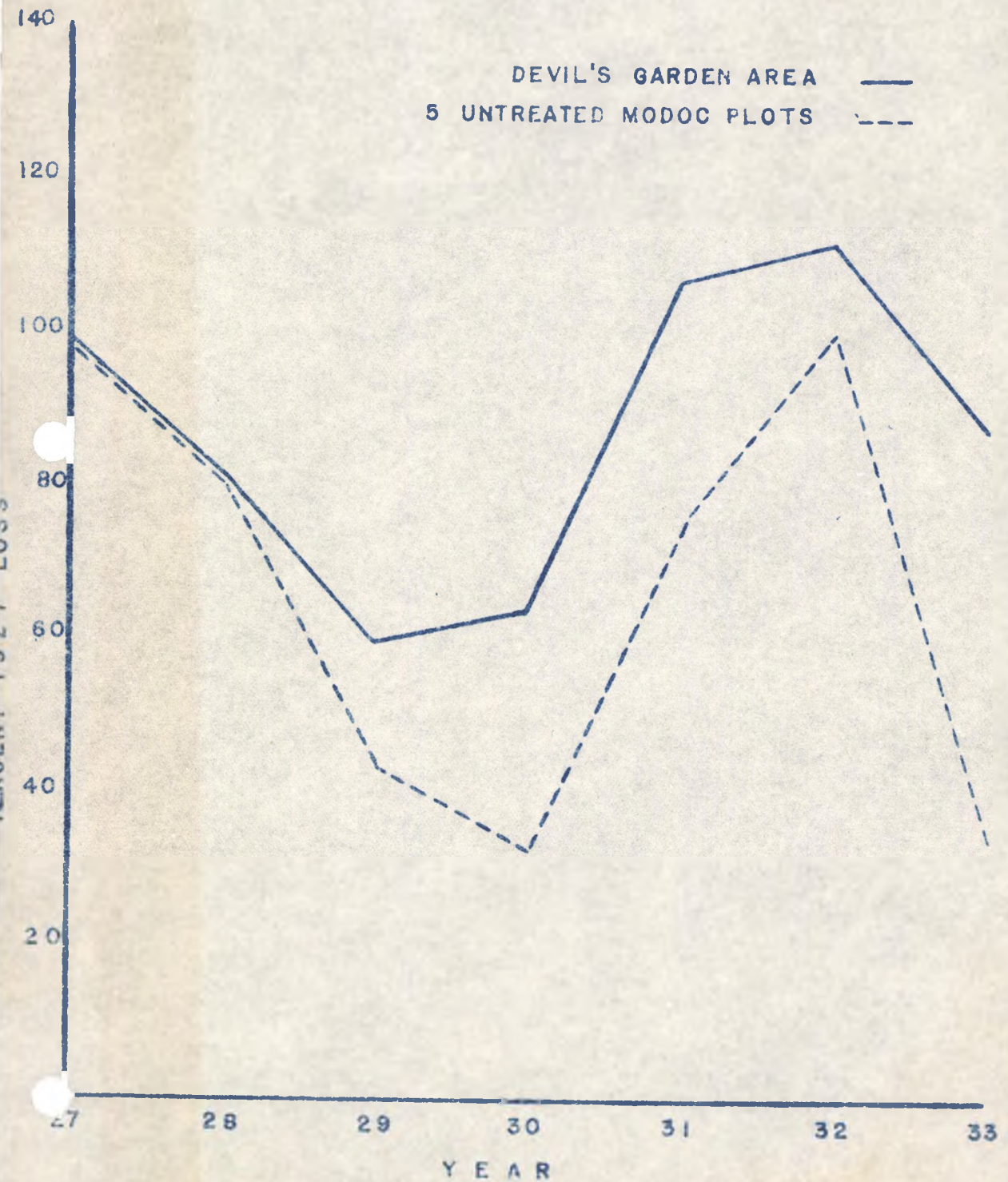


FIGURE 1

VOLUME OF TIMBER INFESTED & TREATED

DEVIL'S GARDEN PROJECT

